# MATHEMATICAL, PHILOSOPHICAL, AND OPTICAL INSTRUMENTS

MADE and SOLD by

## *HEATH* and *WING*,

Near EXETER-EXCHANGE, in the STRAND, *LONDON.*

## INSTRUMENTS *for Geometry-Drawing*, &c.

VARIETY of Pocket Cases of Drawing Instruments, in Silver, Brass, *&c.* containing

Plain Compasses for measuring Lines, *&c.*

Drawing Compaſſes, with the moveable Points.

Drawing Pen, either with or without a protracting pin,

A Sector, either of Box, Ivory, Braſs, or Silver.

A Plain Scale.

A Parallel Ruler.

A Protractor of Braſs.

In the beſt Caſes the Compaſſes are always made with Steel Joints, and the Nibs of all the Pens are made to turn up with a Joint, in order to clean them, in which are alſo ſometimes put a Pair of Hair Compaſſes, ſo contrived on the Inſide of one of the Legs, that an Extent may be taken to an Hair's Breadth, and a Pair of ſmall Boxes for ſmall Circles.

In a Magazine Caſe of Drawing Inſtruments is generally contained all the above Inſtruments together, with the following Particulars:

A Pair of ſtrong Compaſſes, with Calliper and Cutting Points.

A Pair of Beam Compaſſes for drawing larger Circles.

A Pair of proportionable Compaſſes of a new Contrivance.

A Pair of Triangular Compaſſes.

A Pair of Quadrangular Compaſſes.

A Pair of Compaſſes with two Pair of Points, whoſe ſhorter Legs are, at all Openings, always half the Diſtance of the longer one.

A Pair of Plot Compaſſes for meaſuring Charts.

A tracing Point and long Feder.

Elliptical Compaſſes for drawing Ellipſis or Ovals.

A Bow for drawing curved Lines.

A large Plain Scale, } Sometimes theſe are
A Plotting Scale, } all made in one In-
A Protractor, } ſtrument.

Plain and Parallel Rulers of ſeveral Sizes.

Bottles and Shells of Water Colours.

Ivory Pallats for Indian Ink and Colours.

A Pair of Gunner's Callipers of a new Improvement.

In theſe Magazine Caſes, Gentlemen may have what Number of Inſtruments they think proper.

## RULES *of all* SORTS.

Carpenter's Rules, folding Rules, Coggeſhall's ſliding Rules for meaſuring timber, Scamozzi's Rules, Everard's ſliding Rules for Gauging, Leadbeater's ſliding Rule, Bremer's Rule, Malt Canes, Dimenſion Canes, Four Foot Gauging Rules with Joints, Five Foot ditto, Tape Boxes, Five Foot Rods for meaſuring Brick Work, Wainſcoting, Painting, *&c.* in a Walking-ſtick.

Horſe Meaſures in Sticks or Canes.

## SURVEYING INSTRUMENTS.

A plain Table with Index and Sights, whereby the Draught or Plan is taken on the Spot.

Plain Tables, improved with an Index of a peculiar make, whereby the Line of Sights in viewing is always over the Center of the Table, which alſo is readily ſet over the Station Hole, the Station Lines are likewiſe drawn parallel to thoſe meaſured on the Land, and the Table is ſet horizontal by a Spirit Level.

Theodolites, for meaſuring Angles, Diſtances, Altitudes, &c. Thoſe Inſtruments are made various Ways, ſome being more ſimple and portable; others more accurate and expeditious.

The Plain Theodolites, which conſiſts of four plain Sights, two faſtened to the Limb, and two on the Ends of the Index, with a Compaſs on the Index-Plate, divided into Degrees; and the Limb ſubdivided into Minutes by a Nonius's Diviſion; the Whole upon a Ball and Socket, and that placed upon a three-legg'd Staff.

Theodolites of the lateſt Improvments, by T. HEATH. This Inſtrument has a Spirit Level affixed to the Teleſcope, and another, at Right Angles thereto in the Box; by Means of which croſs Levels, and the Help of four Screws playing between two Plates in the Braſs Head of the Staff, the Plate, or

limb

Limb of the Inſtrument, is readily brought to a true horizontal Situation; the Teleſcope, with croſs Hairs therein, turns on an Arch, fixed to the Index perpendicular to the Plate of the Inſtrument; the Arch is of the ſame Radius as the Plate, and the Teleſcope may be elevated or depreſſed thereon quite to a Quadrant, or 90 Degrees: On this Arch are graduated the Degrees of a Circle, which are numbered from the Vertex either Way, with 10, 20, *&c.* and are cut by an Index under the Teleſcope, divided after Vernier's, commonly called Nonius's Way, like thoſe on the Limb of the Inſtrument: Within the Degrees are two Lines, numbered with 10, 20, *&c.* down to 100, and cut by the Edge of the Index, on the Right whereof is graved Elevation, and on the Left Depreſſion. Theſe Lines ſerve to ſhew the Altitude or Depreſſion of any Object in 100th Parts of the Diſtance at which the Inſtrument is planted to take the Obſervation; and are uſeful in finding the Height of a Tree; in the meaſuring of Timber ſtanding; as alſo to find the Altitudes of the ſeveral Parts of a Building, in drawing the Perſpective Appearance thereof.

Circumferentors, the principal Inſtrument for Surveying in the Weſt-Indies.

Gunter's, or Four-Pole Chains.

Off-ſet Staves.

Water-Levels, of all Sorts.

Artillery Levels.

Gunners Levels.

Levelling

Levelling Staves.
Plotting Scales.
Sets of feather-edg'd Scales.
Hair Scales.
A new-improv'd Pantographa, for the ready and exact Reduction, or copying of Deſigns, Schemes, Prints, *&c.*
Pedometers, ſomething like a Watch; by which the Way may be meaſured in Walking.
Meaſuring Wheels, for Surveying of Lands.
Way-Wiſers, for Coaches.
Way-Wiſers, of a curious Contrivance, for Chaiſes.
Gunners Quadrants.
Surveying Quadrants, made of Braſs, or Wood, *&c.*

## NAVIGATION *Inſtruments.*

Gunter's Scales.
Sliding Gunters.
Davis's Quadrant.
Hadley's Reflecting Quadrant.
Mr. Smith's Reflecting Quadrant.
Mr. Smith, Capt. Middleton, and Capt. Harriſon, improv'd.
Azimuth Compaſs.
The Common Azimuth Compaſs.
Mariners Compaſſes, either for the Binacle or Cabin.

Noctur-

Nocturnals.
Plane Scales.
Sinical Quadrants.
Teleſcopes of a new Contrivance, with ſix Glaſſes,
Teleſcopes for Day or Night.
Proſpect and Spy Glaſſes.
Navigation Books, and Charts.

## INSTRUMENTS, *for ſhewing the Motion, Attraction, Weight, and Equilibrio of* BODIES, *&c.*

A Machine, and Glaſs Planes, for the Drop of Oil of Oranges.
Two Planes in a Frame, to be ſet in a Veſſel of tinged Liquor.
Capillary Tubes, and Apparatus.
A Strong Ballance, graduated, for explaining the Properties of Leavers; in which the Power, Reſiſtance, and Point of Suſpenſion, are moveable, and may be readily placed in any given Proportions,
An Inſtrument and Apparatus for three Leavers.
An Axis in Peritrochio.
A Double Cone, that runs up an inclined Plain; which is two Rulers ſo diſpos'd, as to be inclin'd to each other, and to the Horizon, which double inclination may be varied as the Experiment requires.

A little Carriage, and its Appendages, for ſhewing the Advantages great Wheels have over little ones; and that in all Sorts of Roads, as Clay, Gravel, Sand, Pavements, *&c.*

A Glaſs Globe, fixed to a double Axis, which may be whirl'd with any Degree of Velocity, both in a vertical and horizontal Direction.

## INSTRUMENTS *for Experiments on Motion, Weight, and Equilibrio of* FLUIDS.

A Trough lin'd with Lead, with a Cock, for ſeveral Hydroſtatical Experiments.

Several Tubes, bent in different Forms.

Hydroſtatical Bellows.

A Glaſs Tube, with a Bladder fix'd at one End.

A Glaſs Bucket and Wooden Cylinder.

A Hydroſtatical Ballance, of a new Contrivance.

An hollow Glaſs Ball, with a Cock to it, to prove that Water weighs Water.

Areometers, or a Liquor-Proof of Glaſs.

Hydrometers, of Braſs or Copper.

A Cylindrical Glaſs Veſſel, and hollow Images in Glaſs, that may be moved by Compreſſion, without being perceived by the Spectators.

A Model of the Diving-Bell, and Apparatus.

A Common Syphon, and others of different Forms.

A Double Syphon,

A Syphon, whose Arms are moveable by a Joint.

A Tantalus Cup, of several Fashions.

Glass Models of Sucking, Forcing and Lifting Pumps, with or without Air-Vessels, which shew the Reason of Fire-Engines playing with a continual Stream.

A large Fountain by compress'd Air, with Variety of Jet d'Eaux; to which also may be applied an Apparatus for shewing the various Curves that are made by Projectiles.

## INSTRUMENTS *for Pneumatical Experiments*

A small single Barrel Air-Pump.

A large double Barrel, standing, or tall Air-Pump, and Apparatus.

A double Barrel Table Air-Pump.

An Apparatus for the Spirits of Fire in the Vacuo.

A Double Transferer, for communicating a Vacuum from one Receiver to another.

Two Brass Hemispheres, with a Stop-Cock and Rings.

A Wind-Gun, with a condensing Syringe in its Stock, having a Magazine of six Balls, from which one Ball at a Time may be put into the Barrel, without letting the air escape;

and one charging it with Air is ſufficient to the Diſcharge of all the Balls.

Capillary Tubes of various Sizes.

Thermometers for meaſuring the Increaſe or Decreaſe of the Heat and Cold of the Air. } of Spirits of Wine, by Sir Iſaac Newton, by Farenheit, by Reaumeri, by D. Liſle, &c. &c. } ſtandard with Spirits, Oyl, or, Mercury.

Barometers of all Sorts.

An Apparatus for an artificial Storm.

## *OPTICAL* INSTRUMENTS.

Spectacles ground on Braſs Tools, ſet in Silver, Tortoiſeſhell, Horn, &c.

Reading Glaſſes, ſet in Variety of curious Frames,

Concaves for ſhort-ſighted Perſons.

Proſpect Glaſſes of all Lengths.

Opera Glaſſes.

Diagonal Proſpects.

Teleſcopes of all Lengths.

Newtonian Reflecting Teleſcopes.

Gregorian Reflecting Teleſcopes,

Microſcopes, Wilſon's.

———— Opake.

———— Double.

———— Solar Apparatus to ditto.

Camera Obſcura's of all Sorts.

IN-

## INSTRUMENTS *for Experiments on Lights and Colours.*

An Helioſtata, or Machine for directing the Sun's Rays into a dark Chamber, which of itſelf directs the Mirrour in a proper Manner, to caſt the Rays in the ſame Line for ſeveral Hours together.

Solid Glaſs Priſms, mounted on Feet, by which Means they may be raiſed, depreſſed, inclined, or turned upon their Axis.

Priſms of ſolid Glaſs, not mounted.

Several Glaſs Lens, mounted in Frames, on Feet.

A large Paper Screen for Experiments on the Priſms, and the Solar Microſcope.

Concave } Mirrrours of all Sizes.
Convex }

Metalline { Cylinders, Cones, Pyramids, Octagons, } with deformed Pictures

Magick Lanthorns.
Pictures to ditto.

## INSTRUMENTS, *&c. for Experiments on Electricity*, &c.

Natural Armed Loadſtones.
Artificial Loadſtones.
A Compaſs Dial.

Eclipſes of the Sun and Moon, and the Viciſſitudes of the Seaſons, &c.

A Planetarium of two Feet and a half Diameter, with all the Properties of the two foregoing Numbers, and the Addition of the three Superior Planets, Mars, Jupiter, and Saturn, with their annual Motions.

A Planetarium of about three Feet and a half Diameter, handſomely ornamented, containing all the Particulars of the three foregoing Numbers, and the Addition of the diurnal Motions of Mars and Jupiter; together with the Motions of all the Secondary Planets round their reſpective Primaries, in their proper Periods, &c.

All the Planetary Machines are ſo conſtructed, as to render all the Phœnomena (they are intended to demonſtrate) very eaſy and intelligible.

The famous Glaſs-Sphere of the Rev. and Learned Dr. Long's Invention, which exhibits, at one View, both the real and apparent Motion of the Heavens.

*N.B.* Moſt Money for all Sorts of Mathematical, Philoſophical, and Optical Inſtruments.

*FINIS.*

A Long Needle, in oblong Box.
A Sea Compaſs.
A large Glaſs Tube, open at both Ends.
Another that may be exhauſted.
A Glaſs Globe for Whirling.
Another that may be exhauſted, and applied to the Whirling Machine.
Glaſs Plates.
Several little Stands.
A ſolid Stick of Sealing-Wax, of proper Length.
A Tube of ditto.
A Stick of Brimſtone.
A Cone of ditto, covered with a Glaſs.
A little Amber Ball, and another of Coral.
Several little Ivory Cups.
A Metal Pyramid for the Communication of Electricity.
A Suſpender, furniſhed with with Ribbons of different Colours.
A Cake of Roſin and Gum Lac.
A very ſtrong Packthread String, with Bells for communicating Electricity.
Silken Lines for the ſame Purpoſe.
Inſtruments for Aſtronomy, Geography, *&c.* Globes, cœleſtial and terreſtrial, of all Sizes, neatly fitted up, *viz.* of 3, 9, 12, 17, and 28 Inch Diameter, from the lateſt Obſervation.
Armillary Spheres, of any Size.
Large Aſtronomical Quadrants, fitted with a Teleſcope for taking the Declination of the Sun, Moon, and Stars, in the Meridian.

Tranſit

Transit Inſtruments, for determining their right Aſcenſions.

Equal Altitude Inſtruments.

Teleſcopes fitted with a Micrometer.

Helioſcopes, or Inſtruments for obſerving the Spots in the Sun.

Meridian Teleſcopes, for correcting the Motion of a Clock or Watch.

A new Univerſal Sun-Dial on a Pedeſtal.

Horizontal Sun-Dials, of various Kinds.

Sutton's or Collins's Quadrants.

Gunter's Quadrants, &c.

Two Hemiſpheres on the Plane of the Ecliptick, containing all the Stars in Mr. Flamſtead's Catalogue.

Orreries, or Planetariums, 12 Inches Diameter, which ſhews the Motion of the Earth and Moon about the Sun.

Orreries about two Feet Diameter, which ſhews the Motion of the Earth and Moon together, with the Inclination of the Moon's Orbit; the Retrogradation of the Nodes; the annual and diurnal Motion of the Earth, and Motion of the Sun round his Axis, &c.

A Planetarium, about two Feet Diameter, with all the Motions of the laſt Number, and the Addition of the two Inferior Planets, Mercury and Venus, the former having its annual, and the latter both its annual and diurnal Motions: By this Inſtrument the Situation of the Planets, with Reſpect to the Earth at different Times, as they appear direct Stationary or Retrograde, are plainly viſible; as is alſo the

Eclipſes